

PARKLAND COUNTY

Appendix B

MAPS AND FIGURES ON CD-ROM

CD-ROM

- A) Database
- B) ArcView Files
- C) Query
- D) Maps and Figures

1) General

- Index Map
- Surface Casing Types used in Drilled Water Wells
- Location of Water Wells
- Depth of Existing Water Wells
- Bedrock Topography
- Bedrock Geology
- Cross-Section A - A'
- Cross-Section B - B'
- Geologic Column
- Generalized Cross-Section (For terminology only)
- Risk of Groundwater Contamination
- Relative Permeability
- Hydrographs - AEP Observation Water Wells

2) Surficial Aquifers

a) Surficial Deposits

- Thickness of Surficial Deposits
- Non-Pumping Water-Level Surface in Water Wells Completed in Surficial Aquifer(s)
- Total Dissolved Solids in Groundwater from Surficial Deposits
- Sulfate in Groundwater from Surficial Deposits
- Chloride in Groundwater from Surficial Deposits
- Total Hardness of Groundwater from Surficial Deposits
- Piper Diagram - Surficial Deposits
- Amount of Sand and Gravel in Surficial Deposits
- Thickness of Sand and Gravel Aquifer(s)
- Water Wells Completed in Surficial Deposits
- Apparent Yield for Water Wells Completed through Sand and Gravel Aquifer(s)

b) First Sand and Gravel

- Thickness of First Sand and Gravel
- First Sand and Gravel - Saturation

c) Upper Sand and Gravel

- Thickness of Upper Surficial Deposits
- Thickness of Upper Sand and Gravel (not all drill holes fully penetrate surficial deposits)
- Apparent Yield for Water Wells Completed through Upper Sand and Gravel Aquifer

d) Lower Sand and Gravel

- Structure-Contour Map - Top of Lower Surficial Deposits
- Depth to Top of Lower Surficial Deposits
- Thickness of Lower Surficial Deposits
- Thickness of Lower Sand and Gravel (not all drill holes fully penetrate surficial deposits)
- Apparent Yield for Water Wells Completed through Lower Sand and Gravel Aquifer
- Non-Pumping Water-Level Surface in Lower Sand and Gravel Aquifer

3) Bedrock Aquifers

a) General

- Apparent Yield for Water Wells Completed in Upper Bedrock Aquifer(s)
- Total Dissolved Solids in Groundwater from Upper Bedrock Aquifer(s)
- Sulfate in Groundwater from Upper Bedrock Aquifer(s)
- Chloride in Groundwater from Upper Bedrock Aquifer(s)
- Fluoride in Groundwater from Upper Bedrock Aquifer(s)
- Total Hardness of Groundwater from Upper Bedrock Aquifer(s)
- Piper Diagram - Bedrock Aquifer(s)
- Recharge/Discharge Areas between Surficial Deposits and Upper Bedrock Aquifer(s)
- Non-Pumping Water-Level Surface in Upper Bedrock Aquifer(s)

b) Paskapoo Aquifer

Depth to Top of Paskapoo Formation
Non-Pumping Water-Level Surface - Paskapoo Aquifer
Apparent Yield for Water Wells Completed through Paskapoo Aquifer
Total Dissolved Solids in Groundwater from Paskapoo Aquifer
Sulfate in Groundwater from Paskapoo Aquifer
Chloride in Groundwater from Paskapoo Aquifer
Piper Diagram - Paskapoo Formation
Recharge/Discharge Areas between Surficial Deposits and Paskapoo Aquifer

c) Upper Scollard Aquifer

Depth to Top of Upper Scollard Formation
Structure-Contour Map - Top of Upper Scollard Formation
Non-Pumping Water-Level Surface - Upper Scollard Aquifer
Apparent Yield for Water Wells Completed through Upper Scollard Aquifer
Total Dissolved Solids in Groundwater from Upper Scollard Aquifer
Sulfate in Groundwater from Upper Scollard Aquifer
Chloride in Groundwater from Upper Scollard Aquifer
Piper Diagram - Scollard Aquifer(s)
Recharge/Discharge Areas between Surficial Deposits and Upper Scollard Aquifer

d) Lower Scollard Aquifer

Depth to Top of Lower Scollard Formation
Structure-Contour Map - Top of Lower Scollard Formation
Non-Pumping Water-Level Surface - Lower Scollard Aquifer
Apparent Yield for Water Wells Completed through Lower Scollard Aquifer
Total Dissolved Solids in Groundwater from Lower Scollard Aquifer
Sulfate in Groundwater from Lower Scollard Aquifer
Chloride in Groundwater from Lower Scollard Aquifer
Recharge/Discharge Areas between Surficial Deposits and Lower Scollard Aquifer

e) Upper Horseshoe Canyon Aquifer

Depth to Top of Upper Horseshoe Canyon Formation
Structure-Contour Map - Top of Upper Horseshoe Canyon Formation
Non-Pumping Water-Level Surface - Upper Horseshoe Canyon Aquifer
Apparent Yield for Water Wells Completed through Upper Horseshoe Canyon Aquifer
Total Dissolved Solids in Groundwater from Upper Horseshoe Canyon Aquifer
Sulfate in Groundwater from Upper Horseshoe Canyon Aquifer
Chloride in Groundwater from Upper Horseshoe Canyon Aquifer
Piper Diagram - Upper Horseshoe Canyon Aquifer
Recharge/Discharge Areas between Surficial Deposits and Upper Horseshoe Canyon Aquifer

f) Middle Horseshoe Canyon Aquifer

Depth to Top of Middle Horseshoe Canyon Formation
Structure-Contour Map - Top of Middle Horseshoe Canyon Formation
Non-Pumping Water-Level Surface - Middle Horseshoe Canyon Aquifer
Apparent Yield for Water Wells Completed through Middle Horseshoe Canyon Aquifer
Total Dissolved Solids in Groundwater from Middle Horseshoe Canyon Aquifer
Sulfate in Groundwater from Middle Horseshoe Canyon Aquifer
Chloride in Groundwater from Middle Horseshoe Canyon Aquifer
Piper Diagram - Middle Horseshoe Canyon Formation
Recharge/Discharge Areas between Surficial Deposits and Middle Horseshoe Canyon Aquifer

g) Lower Horseshoe Canyon Aquifer

Depth to Top of Lower Horseshoe Canyon Formation
Structure-Contour Map - Top of Lower Horseshoe Canyon Formation
Non-Pumping Water-Level Surface - Lower Horseshoe Canyon Aquifer
Apparent Yield for Water Wells Completed through Lower Horseshoe Canyon Aquifer
Total Dissolved Solids in Groundwater from Lower Horseshoe Canyon Aquifer
Sulfate in Groundwater from Lower Horseshoe Canyon Aquifer
Chloride in Groundwater from Lower Horseshoe Canyon Aquifer
Piper Diagram - Lower Horseshoe Canyon Formation
Recharge/Discharge Areas between Surficial Deposits and Lower Horseshoe Canyon Aquifer

h) Bearpaw Aquitard

Depth to Top of Bearpaw Aquitard
Structure-Contour Map - Top of Bearpaw Aquitard

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APPENDIX C

GENERAL WATER WELL INFORMATION

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Domestic Water Well Testing

Purpose and Requirements

The purpose of the testing of domestic water wells is to obtain background data related to:

- 1) the non-pumping water level for the aquifer - Has there been any lowering of the level since the last measurement?
- 2) the specific capacity of the water well, which indicates the type of contact the water well has with the aquifer;
- 3) the transmissivity of the aquifer and hence an estimate of the projected long-term yield for the water well;
- 4) the chemical, bacteriological and physical quality of the groundwater from the water well.

The testing procedure involves conducting an aquifer test and collecting of groundwater samples for analysis by an accredited laboratory. The date and time of the testing are to be recorded on all data collection sheets. A sketch showing the location of the water well relative to surrounding features is required. The sketch should answer the question, "If this water well is tested in the future, how will the person doing the testing know this is the water well I tested?"

The water well should be taken out of service as long as possible before the start of the aquifer test, preferably not less than 30 minutes before the start of pumping. The non-pumping water level is to be measured 30, 10, and 5 minutes before the start of pumping and immediately before the start of pumping which is to be designated as time 0 for the test. All water levels must be from the same designated reference, usually the top of the casing. Water levels are to be measured during the pumping interval and during the recovery interval after the pump has been turned off; all water measurements are to be with an accuracy of ± 0.01 metres.

During the pumping and recovery intervals, the water level is to be measured at the appropriate times. An example of the time schedule for a 4-hour test is as follows, measured in minutes after the pump is turned on and again after the pump is turned off:

1,2,3,4,6,8,10,13,16,20,25,32,40,50,64,80,100,120.

For a four-hour test, the reading after 120 minutes of pumping will be the same as the 0 minutes of recovery. Under no circumstance will the recovery interval be less than the pumping interval.

Flow rate during the aquifer test should be measured and recorded with the maximum accuracy possible. Ideally, a water meter with an accuracy of better than $\pm 1\%$ displaying instantaneous and total flow should be used. If a water meter is not available, then the time required to completely fill a container of known volume should be recorded, noting the time to the nearest 0.5 seconds or better. Flow rate should be determined and recorded often to ensure a constant pumping rate.

Groundwater samples should be collected as soon as possible after the start of pumping and within 10 minutes of the end of pumping. Initially only the groundwater samples collected near the end of the pumping interval need to be submitted to the accredited laboratory for analysis. All samples must be properly stored for transportation to the laboratory and, in the case of the bacteriological analysis, there is a maximum time allowed between the time the sample is collected and the time the sample is delivered to the laboratory. The first samples collected are only analyzed if there is a problem or a concern with the first samples submitted to the laboratory.

Procedure

Site Diagrams

These diagrams are a map showing the distance to nearby significant features. This would include things like a corner of a building (house, barn, garage etc.) or the distance to the half-mile or mile fence. The description should allow anyone not familiar with the site to be able to unequivocally identify the water well that was tested.

In lieu of a map, UTM coordinates accurate to within five metres would be acceptable. If a hand-held GPS is used, the post-processing correction details must be provided.

Surface Details

The type of surface completion must be noted. This will include such things as a pitless adapter, well pit, pump house, in basement, etc. Also, the reference point used for measuring water levels needs to be noted. This would include top of casing (TOC) XX metres above ground level; well pit lid, XX metres above TOC; TOC in well pit XX metres below ground level.

Groundwater Discharge Point

Where was the flow of groundwater discharge regulated? For example was the discharge through a hydrant downstream from the pressure tank; discharged directly to ground either by connecting directly above the well seal or by pulling the pump up out of the pitless adapter; from a tap on the house downstream from the pressure tank? Also note must be made if any action was taken to ensure the pump would operate continuously during the pumping interval and whether the groundwater was passing through any water-treatment equipment before the discharge point.

Water-Level Measurements

How were the water-level measurements obtained? If obtained using a contact gauge, what type of cable was on the tape, graduated tape or a tape with tags? If a tape with tags, when was the; last time the tags were calibrated? If a graduated tape, what is the serial number of the tape and is the tape shorter than its original length (i.e. is any tape missing)?

If water levels are obtained using a transducer and data logger, the serial numbers of both transducer and data logger are needed and a copy of the calibration sheet. The additional information required is the depth the transducer was set and the length of time between when the transducer was installed and when the calibration water level was measured, plus the length of time between the installation of the transducer and the start of the aquifer test.